

*S/PRTS* - 1 -

DESCRIPTION

«APPARATUS FOR CHECKING THE DIMENSIONAL AND GEOMETRIC  
FEATURES OF PINS»

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Technical Field

The present invention relates to an apparatus for checking  
dimensional and geometric features of a pin, rotating about  
10 a geometric axis of rotation, with a Vee-shaped reference  
device that defines rest and reference surfaces adapted for  
cooperating with the pin to be checked, a gauging device,  
coupled to the Vee-shaped reference device and including a  
feeler adapted for contacting the surface of the pin to be  
15 checked and for performing linear displacements along a  
measurement direction lying between the rest and reference  
surfaces of the Vee-shaped reference device, a support  
device for supporting the Vee-shaped reference device and  
the gauging device, with a stationary support element and a  
20 coupling mechanism, between the stationary support element  
and the Vee-shaped reference device, adapted for enabling,  
when the apparatus is in a working condition, substantially  
translation displacements of the Vee-shaped reference  
device with respect to the stationary support element, the  
25 coupling mechanism including a first section coupled to the  
stationary support element, an intermediate element coupled  
to the first section, and a second section coupled to the  
intermediate element and carrying the Vee-shaped reference  
device and the gauging device, at least one of the first  
30 and second sections including, in the working condition, a  
first substantially parallelogram type structure with four  
fulcra that define as many axes of rotation parallel to the  
geometric axis of rotation and coupling and limiting  
elements adapted for defining and setting a distance  
35 separating adjacent axes of rotation, and a control device  
for enabling the apparatus to displace in an automatic way  
from a rest position to the working condition, and vice

versa.

Background Art

5 Apparatuses for the crankpin diameter checking of a  
crankshaft rotating with orbital motion about a geometric  
axis in the course of the machining in a grinding machine  
are disclosed in international patent application published  
with No. WO-A-9712724, filed by the same applicant of the  
10 present patent application.  
More specifically, according to the embodiments shown and  
described in the previously detailed international patent  
application, the apparatuses have Vee-shaped reference  
devices that rest on the crankpin to be checked and  
15 maintain correct cooperation with the surface of the  
crankpin substantially by virtue of the force of gravity.  
The embodiments disclosed in the formerly detailed  
international patent application guarantee excellent  
metrological results and small forces of inertia and the  
20 standards of performance of the apparatuses with these  
characteristics, manufactured by the applicant of the  
present patent application, confirm the remarkable quality  
and reliability of the applications.  
Furthermore, these known apparatuses can be utilized for  
25 carrying out roundness checkings of the cylindrical  
surfaces of the pins, while the crankshaft is assembled and  
rotating on the grinding machine.  
International patent application published with No. WO-A-  
0166306, also filed by the same applicant of the present  
30 patent application, relates to an apparatus and a method  
for checking the roundness of crankpins in orbital rotation  
on a grinding machine. This international patent  
application discloses the detecting of diameter dimensions  
of the crankpin, at predetermined angular positions during  
35 the crankshaft rotation, by means of a gauging head  
including a feeler and Vee-shaped reference surfaces that  
rest on the piece and a transducer that detects

CLAIMS

1. An apparatus for checking dimensional and geometric features of a pin (42), rotating about a geometric axis of rotation (8), with
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- a Vee-shaped reference device (70) that defines rest and reference surfaces adapted for cooperating with the pin (42) to be checked,
  - a gauging device (61), coupled to the Vee-shaped reference device (70) and including a feeler (67) adapted for contacting the surface of the pin (42) to be checked and for performing linear displacements along a measurement direction (D) lying between said rest and reference surfaces of the Vee-shaped reference device (70);
  - a support device for supporting the Vee-shaped reference device (70) and the gauging device (61), with a stationary support element (5) and a coupling mechanism, between the stationary support element (5) and the Vee-shaped reference device (70), adapted for enabling, when the apparatus is in a working condition, substantially translation displacements of the Vee-shaped reference device (70) with respect to the stationary support element (5), the coupling mechanism including
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- a first section (40) coupled to the stationary support element (5),
  - an intermediate element (12) coupled to the first section (40), and
  - a second section (41) coupled to the intermediate element (12) and carrying the Vee-shaped reference device (70) and the gauging device (61),
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- at least one of said first and second sections including, in said working condition, a first substantially parallelogram structure (40) with four fulcra (6,10,13,17) that define as many axes of rotation (7,11,14,18) parallel to said geometric axis of rotation (8) and coupling and limiting elements (9,32) adapted for defining and setting a

distance separating adjacent axes of rotation (7,11,14,18),  
and

▪ a control device (80-83) for enabling the apparatus to  
displace in an automatic way from a rest position to  
5 said working condition, and vice versa  
characterized in that said first substantially  
parallelogram structure (40) includes at least one pair of  
mechanical abutments (38,16) adapted for holding mutual  
contact in said working condition for defining and setting  
10 the distance separating two adjacent axes of rotation  
(14,18), and for remaining mutually separate in said rest  
position of the apparatus.

2. The apparatus according to claim 1, wherein said first  
15 substantially parallelogram structure (40) includes an  
additional pair of mechanical abutments (39,20) adapted for  
holding mutual contact in said working condition.

3. The apparatus according to claim 2, wherein said  
20 coupling and limiting elements include at least an elongate  
coupling element (9) defined between two adjacent fulcra  
(6,10) and a stem (32) arranged - in said working condition  
- between the other two fulcra (13,17), the stem (32) being  
coupled to said elongate element (9) and arranged, in an  
25 axially movable way along a direction substantially  
parallel to said elongate element (9), the ends (38,39) of  
said stem (32) and the elements (15,19) integral with said  
other two fulcra (13,17) defining the mechanical abutments  
(38,16;39,20) of said at least one and additional pairs.

30 4. The apparatus according to claim 3, wherein said  
elements integral with said other two fulcra (13,17) are  
the bearings (15,19) with the associated external  
cylindrical surfaces (16,20) that define mechanical  
35 abutments of said at least one and additional pairs.


INTERNATIONAL PRELIMINARY EXAMINATION REPORT  
(PCT Article 36 and Rule 70)

Rec'd PCT/PTO 02 DEC 2004

Applicant's or agent's file reference BRE/356	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/EP 03/05740	International filing date (day/month/year) 02.06.2003	Priority date (day/month/year) 12.06.2002
International Patent Classification (IPC) or both national classification and IPC B24B49/04		
Applicant MARPOSS SOCIETÀ PER AZIONI		

- This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 5 sheets, including this cover sheet.  
  
☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).  
  
 These annexes consist of a total of 4 sheets.

- This report contains indications relating to the following items:
  - I ☒ Basis of the opinion
  - II ☐ Priority
  - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - IV ☐ Lack of unity of invention
  - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - VI ☐ Certain documents cited
  - VII ☐ Certain defects in the international application
  - VIII ☐ Certain observations on the international application

Date of submission of the demand  08.01.2004	Date of completion of this report  02.07.2004
Name and mailing address of the international preliminary examining authority:   European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer  Schultz, T  Telephone No. +31 70 340-4559



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. **PCT/EP 03/05740**

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, Pages**

3-16 as originally filed  
1, 2 received on 01.06.2004 with letter of 28.05.2004

**Claims, Numbers**

5-12 as originally filed  
1-4 received on 01.06.2004 with letter of 28.05.2004

**Drawings, Sheets**

1/5-5/5 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

☐ the description, pages:

☐ the claims, Nos.:

☐ the drawings, sheets:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. **PCT/EP 03/05740**

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes: Claims	1-12
	No: Claims	
Inventive step (IS)	Yes: Claims	1-12
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-12
	No: Claims	

**2. Citations and explanations**

**see separate sheet**

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Reference is made to the following document:

D1: EP-A-1 118 833 (MARPOSS APP ELETT) 25 July 2001 (2001-07-25)

2. The document **D1** is regarded as being the closest prior art to the subject-matter of independent claim 1, and shows (the references in parentheses applying to this document) an apparatus for checking dimensional and geometric features of a pin with a Vee-shaped reference device (20), a gauging device (17), a support device(5) and a control device (28, 30).

The subject-matter of claim 1 differs from this known apparatus in that when the apparatus is in a working condition, substantially translation displacements of the Vee-shaped reference device are enabled and a first parallelogram structure includes at least one pair of mechanical abutments for holding mutual contact in said working condition and for remaining mutually separate in a rest position of the apparatus.

The subject-matter of independent claim 1 is therefore new (Article 33(2) PCT).

The problem to be solved by the present invention may be regarded as keeping the angular arrangement of the instantaneous point of contact of the feeler with the surface of the workpiece to be checked independently of variations in the configuration of the support device. It may further be regarded as defining a distance separating two adjacent axes of rotation of the first parallelogram structure thereby defining a minimum value of angles between the intermediate element and the coupling element and providing an additional support in the working condition of the apparatus.

The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons: The problem of a constant angular arrangement of the feeler with the surface of the workpiece as stated above is not addressed in the cited prior art D1.

~~D1 discloses further a disengagement between the abutment surfaces depending~~  
on the position of the rotating workpiece to be checked. D1 does not therefore



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/EP 03/05740

suggest to keep the abutment surfaces in mutual contact in the working conditon.  
Thus , the subject-matter of claim 1 involves an inventive step , Art. 33(3)PCT.

3. Claims 2-12 are dependent claims and are therefore also novel and inventive.